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HESSIAN FLY IN WHEAT
CONTROL METHODS AND SAFE DATES FOR
SOWING SEED

KEEP THIS BULLETIN FOR REFERENCE

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HESSIAN FLY IN WHEAT

By **FRANKLIN SHERMAN**
Chief in Entomology

INTRODUCTION

The Hessian Fly did an unusual amount of damage to wheat in North Carolina during the growing season of 1917-18. At this writing (July, 1918) great numbers of them are present in the stubble in the maggot or flaxseed stage, and from these adult Hessian Flies will emerge in the fall and lay their eggs upon whatever wheat is up at that time—unless this be prevented.

The prevention of damage by the Hessian Fly depends chiefly upon two methods of procedure: (1) to avoid it by sowing wheat at a sufficiently late date in the fall so that it will not come up until after the fall brood of Fly has died, and (2) to kill or prevent the development of the Fly in the stubble by burning over the field after harvest or by plowing the stubble under deeply before September, or by both burning over and plowing. This is especially advisable in seasons when the Flies in the stubble are as numerous as they are in this summer of 1918. These methods of control are further explained in the following pages.

Many farmers of this state were disappointed in the wheat yield of 1918. The Hessian Fly was one of several causes which contributed to this. The special emphasis placed upon wheat-production in 1917 doubtless resulted in some wheat being sown on land which was not well suited to it, some on land which was not suitably prepared, some sown unseasonably early, and some sown unseasonably late. As evidence on this latter point the author found wheat on one farm representing four distinct dates of sowing, varying from September 30 to October 31, and only a few miles away found another field sown as late as November 30. These cases show a variation of two months in the time of sowing wheat in the same locality. It is also known that certain fungous diseases were a factor in reducing the yield.

Experienced wheat farmers are generally aware that early-sown wheat is more subject to injury by Hessian Fly than that which is sown later. "After the first heavy frost" has become almost a proverb for sowing wheat, hence the Hessian Fly does not often do very serious damage to our wheat. But "after first heavy frost" is a very indefinite and highly variable date. Heavy frost may come unseasonably early, or it may be delayed until an unseasonably late date. It is generally a fairly good guide, but it is too variable to be followed if a better guide can be found.

It is believed that a better guide has been found, and is set forth in the tables of wheat-sowing dates for numerous localities in the following pages.

To sow the wheat late enough to escape Hessian Fly, and yet early enough to escape winter-killing, has long been a topic for thought, study, and experiment among farmers and entomologists. The general opinion has long prevailed that in order to avoid the Fly it is necessary to sow wheat later than would otherwise be best. "My early wheat does best when the Fly doesn't get it," and "I would prefer to sow earlier if it were not for the Fly," are common remarks. Yet the author has long been convinced that many farmers in their fear of Fly sow later than is necessary and often too late for best results. A plan whereby a general average proper date can be specified has long been needed. As long ago as 1903-04 the author, after obtaining opinions from many farmers throughout our chief wheat section, concluded that October 15th was the best general date that could be specified, and he has mentioned this at many farmers meetings—i.e., that wheat sown earlier than October 15th was liable to damage by Fly, and that wheat sown later was apt to escape damage. This date does mark the approximate proper season in our chief wheat section—but it is evident that this will vary in different sections.

To Dr. A. D. Hopkins, Forest Entomologist of the Bureau of Entomology, U. S. Department of Agriculture, is due the credit for having worked out a comprehensive plan which apparently enables us to determine **THE BEST** wheat-sowing period for average seasons (all things considered) for any locality in North Carolina of which the elevation above sea-level is known, and the same plan can be applied in other states also. A poster with "map-and-calendar" for North Carolina was issued by the U. S. Department of Agriculture in 1917. The author of this Bulletin calculated the periods for wheat-sowing for our chief wheat counties from this poster, and sent them to the county farm agents. Nevertheless, much wheat was sown outside of the periods recommended, and Hessian Fly has done serious damage. Also, the progress of the season in the fall of 1917 appears to have been in some respects abnormal.

We have had the application of this plan under consideration for nearly a year. Sowing-dates calculated from it have been submitted to many intelligent persons, both ones with local and with state-wide experience. It is found that the dates as here calculated are in close accord with results of experiments conducted by the Division of Agronomy of our Experiment Station, which has conducted five-year tests in many localities. We are convinced that the sowing-periods derived from this

plan are by all means the safest that can be advised for the general guidance of our wheat-farmers. We present the schedule of wheat sowing dates calculated for 755 postoffice localities in North Carolina on the following pages. *We most strongly advise, urge, and entreat every wheat-grower to adopt these dates as his guide, and we urge every county farm agent to base his advice upon them.* Remember that these dates are not recommended merely and solely with reference to Hessian Fly, but are believed (with much reason) to be the safest sowing-periods for general practice in average seasons, *all things considered.* Calculations are also included for counties or parts of counties, exact elevations of which are not known, but for which dates can be accurately computed. We believe that if all our farmers would follow these calculations (making perhaps slight deviations for seasons which are obviously abnormal), that it will result in even less damage by Hessian Fly than we have heretofore experienced by eliminating unseasonably early sowing, and that it will result in less damage from winter killing by elimination of unreasonably late sowing.

CONTROL OF HESSIAN FLY IN WHEAT

The prevention of damage by the Hessian Fly depends chiefly upon the disposal of stubble after harvest, following an outbreak—and sowing at such date that the Fly will not attack it in the fall.

Burning.—While we are aware that it is not good practice to burn vegetable matter which can be returned to the soil with benefit, and knowing that humus is one of the chief things needed in many of our soils, yet we are fully convinced that in cases where there is much Hessian Fly in the stubble at harvest it is advisable to burn over the stubble between harvest and mid-August to kill the developing insects in the stubble, if there is no stronger reason to the contrary and of course if the stubble will permit burning, which it often does.

There may be stronger reasons to the contrary. If there is a good crop of grass or clover coming on in the stubble, the value of this may outweigh the desirability of destroying the Fly. If there is only a very poor stand of grass or clover and the Fly is very numerous in the stubble then it would certainly be better to destroy the Fly, sacrificing the grass or clover. On this point, therefore, the farmer must use his judgment according to how valuable the stubble-crop is, how numerous the Fly is, and the importance of the wheat-crop to be sown the following fall to himself, to his community, and to the country. We are strongly of the opinion that any badly-infested wheat-stubble which is not growing a valuable crop, should be so treated as to prevent Flies emerging from it

in fall. Burning is one method, plowing under is the other. Burning and then plowing under (a combination of both methods) is the most that could be asked.

Plowing Under Stubble.—There is less objection to this method because it saves the vegetable matter to the land, but it is evident that plowing under alone will not destroy so large a percentage of the Flies as both the burning and the plowing would do. The Hessian Flies which emerge in early fall are frail, delicate little creatures and cannot emerge if buried under four to six inches of soil. The stubble-field should therefore be deeply plowed to bury all the stubble, as much of it as possible to a depth of five inches or more.

Plowing under wheat-stubble promptly after harvest and sowing to peas is an excellent step in control of Fly which is already in common practice in this state. Its effectiveness will be increased by plowing under more deeply and to see that *all* of the stubble is buried so far as may be practicable. In seasons when there is much Fly in the stubble, like the present, it is all the better if the stubble be burned over before plowing under.

Destruction of Volunteer Wheat.—Volunteer wheat (which comes up of its own accord in late summer in neighborhood of stacks or barns, or in fields if grain was shattered in harvest) should be persistently and carefully destroyed, especially in seasons when there is much Fly developing in the stubble.

Destroy the Fly in the Stubble.—Having discussed the two methods of burning and plowing to get rid of the developing Flies in the stubble we wish to emphasize the point by repeating it.

Every acre of badly infested wheat-stubble, especially in our chief wheat-growing counties, which is not growing a valuable crop should be disposed of by plowing under deeply or burning by Mid-August—this in order to lessen the number of Flies to emerge in early fall to attack the fall-sown wheat. And this should be followed up by the destruction of all volunteer wheat.

County farm agents, and all intelligent farmers, may well spread this advice among their acquaintances.

SAFEST DATES TO SOW WHEAT

To Avoid Hessian Fly—To Avoid Winter-killing—To Make Highest Yield

Many of our farmers already know that later-sown wheat is less apt to be hurt by Fly than that which is sown earlier, but it is found that this is not always followed in practice so that some wheat is sown so

early as to invite Fly-attack, while some is sown later than there is need for and runs needless risk of winter-killing. This gives an irregular, unsystematized sowing period and often results in loss to the more careless farmers either from Fly on the one hand or winter-killing on the other. A large percentage of our best wheat-farmers, however, are already in the practice of sowing their wheat well within, or close to, the dates which are believed to be safest. In order to give stability and system to our wheat-sowing procedure, a table is presented in which the wheat-sowing period has been calculated for seven hundred and ninety-six localities. The calculation is based upon the geographical location (modification of longitude and latitude) and upon elevation above sea-level. A ten-day period is indicated for each locality. This indicates that if wheat is sown earlier than the earliest of the two dates it is in danger of being hurt by the fall brood of Fly, while if it is sown later than the latest date given there will be danger of winter-killing. The whole general plan from which these calculations are made, is based upon careful study of many factors, including the known facts in the life-history of the Hessian Fly, weather records the country over as to dates of killing frosts, leafing and blooming period of certain trees, and reports from forty thousand farmers in the United States as to the average dates for beginning and completing the sowing of wheat. It is known that the dates correspond reasonably well with the present practice of the best wheat farmers in our main wheat-growing section, and *it is hoped that every farmer and every county farm agent will follow these dates in practice and advice, at least until or unless there is unquestionable local experience to warrant a departure.*

If a farmer is in a locality not given in the list, he can ascertain the periods for one or more localities near by, and judge his period, sowing earlier if he is at higher elevation, or later if at lower elevation, 4 days for each 400 feet (approximate) difference.

There will of course be occasional exceptional seasons in which the Fly will emerge so late in the fall as to infest the late-sown wheat as much, or possibly even more, than the early-sown, but such seasons are clearly exceptions to the rule. Also, a protracted drouth will delay the emergence of the Fly, so if a drouth extends into the sowing period it is well to delay sowing until after a general rain, if this comes before it is dangerously late for sowing. If the drouth persists one should sow by, at, or soon after the close of the period.

(See Map and Calendar, pp. 32 and 33.)

STANDARD TEN-DAY PERIODS FOR SOWING WHEAT IN NORTH CAROLINA

To Avoid Hessian Fly—To Avoid Winter-killing—To Make Highest Yield

COUNTY	LOCALITY	Elevation above sea-level (in feet)	Ten-day Period for Sowing Wheat
ALAMANCE	Burlington	662	Oct. 14 to Oct. 24
	Elon College	716	Oct. 14 to Oct. 24
	Graham	641	Oct. 14 to Oct. 24
	Haw River	536	Oct. 19 to Oct. 28
	Mebane	678	Oct. 14 to Oct. 24
	Southern part of county	at 600	Oct. 18 to Oct. 28
	Northern part of county	at 700	Oct. 13 to Oct. 23
ALEXANDER	Dealville	1,150	Oct. 12 to Oct. 22
	Hiddenite	1,140	Oct. 12 to Oct. 22
	Taylorsville	1,400	Oct. 12 to Oct. 22
	North end of county	at 1,500	Oct. 8 to Oct. 18
	North end of county	at 1,600	Oct. 8 to Oct. 18
	North end of county	at 1,700	Oct. 8 to Oct. 18
	North end of county	at 1,800	Oct. 8 to Oct. 18
	In Brushy Mountains	at 2,000	Oct. 4 to Oct. 14
ALLEGHANY	Cherrylane	2,810	Sept. 24 to Oct. 4
	Laurel Springs	2,850	Sept. 24 to Oct. 4
	Sparta	2,850	Sept. 23 to Oct. 3
	Whitehead	2,800	Sept. 24 to Oct. 4
	All north half of county	about 2,800	Sept. 23 to Oct. 3
ANSON	Lilesville	470	Oct. 23 to Nov. 2
	McFarlan	297	Oct. 25 to Nov. 4
	Morven	341	Oct. 23 to Nov. 2
	Peachland	417	Oct. 23 to Nov. 2
	Pee Dee	242	Oct. 25 to Nov. 4
	Polkton	292	Oct. 25 to Nov. 4
	Wadesboro	419	Oct. 23 to Nov. 2
ASHE	Applegate	3,137	Sept. 20 to Sept. 30
	Baldwin	3,250	Sept. 20 to Sept. 30
	Beaver Creek	2,990	Sept. 24 to Oct. 4
	Brandon	2,850	Sept. 24 to Oct. 4
	Clifton	2,900	Sept. 24 to Oct. 4
	Creston	2,850	Sept. 24 to Oct. 4
	Dandy	3,455	Sept. 16 to Sept. 26
	Dresden	2,800	Sept. 24 to Oct. 4
	Fig	2,880	Sept. 24 to Oct. 4
	Helton	2,850	Sept. 24 to Oct. 4
	Idlewild	2,700	Sept. 24 to Oct. 4
	Jefferson	2,900	Sept. 24 to Oct. 4
	Nathan's Creek	2,800	Sept. 24 to Oct. 4
	Obids	2,800	Sept. 24 to Oct. 4
	Ore Knob	3,150	Sept. 20 to Sept. 30
	Pinckton	3,498	Sept. 16 to Sept. 26
	Riverside	2,950	Sept. 25 to Oct. 5
	Scottsville	2,950	Sept. 24 to Oct. 4
	Silas Creek	2,740	Sept. 24 to Oct. 4
	Thaxton	3,700	Sept. 16 to Sept. 26
	Transou	3,000	Sept. 24 to Oct. 4
	Trout	2,900	Sept. 24 to Oct. 4
	Weaversford	2,500	Sept. 28 to Oct. 8

COUNTY	LOCALITY	Elevation above sea-level (in feet)	Ten-day Period for Sowing Wheat
AVERY	Banner's Elk	3,700	Sept. 17 to Sept. 27
	Beech Creek	2,630	Sept. 25 to Oct. 5
	Cranberry	3,250	Sept. 22 to Oct. 2
	Crossnore	3,400	Sept. 22 to Oct. 2
	Darkridge	3,000	Sept. 25 to Oct. 5
	Elk Park	3,250	Sept. 21 to Oct. 1
	Frank	3,100	Sept. 22 to Oct. 2
	Gragg	2,890	Sept. 26 to Oct. 6
	Ingalls	2,800	Sept. 26 to Oct. 6
	Linville	3,800	Sept. 18 to Sept. 28
	Minneapolis	3,400	Sept. 22 to Oct. 2
	Montezuma	3,882	Sept. 14 to Sept. 24
	Newland	3,695	Sept. 18 to Sept. 28
	Pineola	3,900	Sept. 14 to Sept. 24
	Plumtree	2,839	Sept. 26 to Oct. 6
	Senia	3,400	Sept. 22 to Oct. 2
	Spear	2,839	Sept. 26 to Oct. 6
	Valley	4,000	Sept. 14 to Sept. 24
BEAUFORT	Bath	9	Oct. 20 to Oct. 30
	Belhaven	4	Oct. 20 to Oct. 30
	Chocowinity	40	Oct. 20 to Oct. 30
	Pantego	10	Oct. 20 to Oct. 30
	Pinetown	40	Oct. 20 to Oct. 30
	Pungo	3	Oct. 19 to Oct. 29
	Terra Ceia	18	Oct. 20 to Oct. 30
	Washington	11	Oct. 20 to Oct. 30
BERTIE	Kelford	93	Oct. 18 to Oct. 28
	Lewiston	76	Oct. 18 to Oct. 28
	Quitsna	29	Oct. 18 to Oct. 28
	Roxobel	97	Oct. 18 to Oct. 28
BLADEN	Abbottsburg	106	Oct. 25 to Nov. 4
	Bladenboro	105	Oct. 25 to Nov. 4
	Clarkton	104	Oct. 25 to Nov. 4
	Jerome	194	Oct. 24 to Nov. 3
	Rosindale	120	Oct. 25 to Nov. 4
	White Oak	46	Oct. 24 to Nov. 3
BRUNSWICK	Phoenix	40	Oct. 26 to Nov. 5
	Southport	34	Oct. 27 to Nov. 6
	All south of Old Town Creek..	Oct. 27 to Nov. 6
	All north of Old Town Creek..	Oct. 26 to Nov. 5
BUNCOMBE	Acton	2,000	Oct. 6 to Oct. 16
	Alexander	1,791	Oct. 10 to Oct. 20
	Arden	2,250	Oct. 2 to Oct. 12
	Asheville (P.O.)	2,208	Oct. 2 to Oct. 12
	Azalea	2,053	Oct. 2 to Oct. 12
	Barnardsville	2,185	Oct. 5 to Oct. 15
	Beech	2,350	Oct. 2 to Oct. 12
	Biltmore	1,994	Oct. 6 to Oct. 16
	Black Mountain	2,367	Oct. 2 to Oct. 12
	Candler	2,125	Oct. 6 to Oct. 16
	Canto	2,250	Oct. 2 to Oct. 12
	Democrat	2,119	Oct. 5 to Oct. 15
	Fairview	2,250	Oct. 2 to Oct. 12
	Gem	2,500	Oct. 2 to Oct. 12

COUNTY	LOCALITY	Elevation above sea-level (in feet)	Ten-day Period for Sowing Wheat
BUNCOMBE—Cont.	Leicester	2,108	Oct. 6 to Oct. 16
	Sandy Mush	2,250	Oct. 2 to Oct. 12
	Skyland	2,254	Oct. 3 to Oct. 13
	Stocksville	2,250	Oct. 2 to Oct. 12
	Swannanoa	2,222	Oct. 2 to Oct. 12
	Weaverville	2,300	Oct. 2 to Oct. 12
BURKE	Connelly Springs	1,194	Oct. 13 to Oct. 23
	Drexel	1,191	Oct. 13 to Oct. 23
	Glen Alpine	1,210	Oct. 13 to Oct. 23
	Hildebran	1,148	Oct. 13 to Oct. 23
	Joy	1,091	Oct. 13 to Oct. 23
	Morganton	1,181	Oct. 13 to Oct. 23
	Tablerock	1,268	Oct. 13 to Oct. 23
	Valdese	1,202	Oct. 13 to Oct. 23
	North corner of county.....	at 1,500	Oct. 8 to Oct. 18
	On South Mountain.....	at 1,500	Oct. 9 to Oct. 19
CABARRUS	Concord	705	Oct. 17 to Oct. 27
	Glass	770	Oct. 17 to Oct. 27
	Harrisburg	610	Oct. 18 to Oct. 28
	Mount Pleasant	750	Oct. 17 to Oct. 27
CALDWELL	Buffalo Cove	1,425	Oct. 7 to Oct. 17
	Globe	1,325	Oct. 12 to Oct. 22
	Granite Falls	1,211	Oct. 12 to Oct. 22
	Hudson	1,272	Oct. 12 to Oct. 22
	Kings Creek	1,250	Oct. 12 to Oct. 22
	Lenoir	1,182	Oct. 12 to Oct. 22
	Patterson	1,307	Oct. 12 to Oct. 22
	Upton	1,420	Oct. 8 to Oct. 18
	Yadkin Valley	1,300	Oct. 12 to Oct. 22
CAMDEN	Belcross	7	Oct. 16 to Oct. 26
	Camden	10	Oct. 16 to Oct. 26
CARTERET	Beaufort	12	Oct. 23 to Nov. 2
	Bogue	62	Oct. 23 to Nov. 2
	Morehead City	15	Oct. 23 to Nov. 2
	Newport	19	Oct. 23 to Nov. 2
	Wildwood	20	Oct. 23 to Nov. 2
CASWELL	Pelham	740	Oct. 12 to Oct. 22
	North half of county.....	at 600	Oct. 12 to Oct. 22
	North half of county.....	at 800	Oct. 12 to Oct. 22
	South half of county.....	at 600	Oct. 13 to Oct. 23
	South half of county.....	at 700	Oct. 13 to Oct. 23
	South half of county.....	at 800	Oct. 13 to Oct. 23
CATAWBA	Catawba	1,000	Oct. 13 to Oct. 23
	Claremont	968	Oct. 17 to Oct. 27
	Conover	1,065	Oct. 13 to Oct. 23
	Hickory	1,163	Oct. 13 to Oct. 23
	Malden	891	Oct. 17 to Oct. 27
	Monbo	750	Oct. 17 to Oct. 27
	Newton	975	Oct. 17 to Oct. 27
	Sherrills Ford	960	Oct. 17 to Oct. 27

COUNTY	LOCALITY	Elevation above sea-level (in feet)	Ten-day Period for Sowing Wheat
CHATHAM	Goldston	419	Oct. 19 to Oct. 29
	Gulf	275	Oct. 21 to Oct. 31
	Merry Oaks	247	Oct. 21 to Oct. 31
	Moncure	176	Oct. 21 to Oct. 31
	Ore Hill	495	Oct. 19 to Oct. 29
	Pittsboro	480	Oct. 19 to Oct. 29
	Siler City.....	590	Oct. 19 to Oct. 29
CHEROKEE	Andrews	1,750	Oct. 13 to Oct. 23
	Culberson	1,646	Oct. 14 to Oct. 24
	Hiawassee	1,375	Oct. 17 to Oct. 27
	Kinsey	1,550	Oct. 13 to Oct. 23
	Marble	1,710	Oct. 13 to Oct. 23
	Murphy	1,540	Oct. 13 to Oct. 23
	Ogreeta	1,450	Oct. 13 to Oct. 23
	Patrick	1,650	Oct. 13 to Oct. 23
	Postell	1,900	Oct. 9 to Oct. 19
	Ranger	1,600	Oct. 13 to Oct. 23
	Tomotla	1,600	Oct. 13 to Oct. 23
	Topton	2,800	Sept. 30 to Oct. 10
	Unaka	1,675	Oct. 13 to Oct. 23
	Vests	1,600	Oct. 13 to Oct. 23
CHOWAN	Edenton	16	Oct. 18 to Oct. 28
	Gliden	36	Oct. 17 to Oct. 27
	Ryland	41	Oct. 17 to Oct. 27
	Tulu	42	Oct. 17 to Oct. 27
	Tyner	48	Oct. 17 to Oct. 27
CLAY	Brasstown	1,650	Oct. 13 to Oct. 23
	Hayesville	1,893	Oct. 9 to Oct. 19
	Ogden	1,850	Oct. 9 to Oct. 19
	Shooting Creek	2,130	Oct. 9 to Oct. 19
	Twine	1,890	Oct. 9 to Oct. 19
	Warne	1,800	Oct. 9 to Oct. 19
CLEVELAND	Earl	850	Oct. 19 to Oct. 29
	Fallston	1,029	Oct. 14 to Oct. 24
	Grover	860	Oct. 19 to Oct. 29
	Kings Mountain (P.O.)	952	Oct. 19 to Oct. 29
	Lattimore	945	Oct. 19 to Oct. 29
	Mooresboro	970	Oct. 19 to Oct. 29
COLUMBUS	Cerro Gordo	93	Oct. 26 to Nov. 5
	Chadbourn	106	Oct. 26 to Nov. 5
	Fairbluff	69	Oct. 26 to Nov. 5
	Freeman	55	Oct. 26 to Nov. 5
	Whiteville	59	Oct. 26 to Nov. 5
	Southern corner of county	less than 100	Oct. 27 to Nov. 6
CRAVEN	Askin	18	Oct. 21 to Oct. 31
	Clark	31	Oct. 22 to Nov. 1
	Cove City.....	47	Oct. 22 to Nov. 1
	Croatan	29	Oct. 22 to Nov. 1
	Dover	63	Oct. 22 to Nov. 1
	Fort Barnwell	40	Oct. 21 to Oct. 31
	Havelock	23	Oct. 23 to Nov. 2
	New Bern	15	Oct. 22 to Nov. 1
	Riverdale	25	Oct. 22 to Nov. 1

COUNTY	LOCALITY	Elevation above sea-level (in feet)	Ten-day Period for Sowing Wheat
CRAVEN—Cont.	Tuscarora	39	Oct. 22 to Nov. 1
	Vanceboro	22	Oct. 21 to Oct. 31
CUMBERLAND ...	Cooper	240	Oct. 23 to Nov. 2
	Fayetteville	101	Oct. 23 to Nov. 2
	Godwin	160	Oct. 23 to Nov. 2
	Hope Mills	120	Oct. 24 to Nov. 3
	Manchester	173	Oct. 23 to Nov. 2
	Stedman	131	Oct. 23 to Nov. 2
	Wade	141	Oct. 23 to Nov. 2
CURRITUCK	Gregory	11	Oct. 16 to Oct. 26
	Kittyhawk	9	Oct. 16 to Oct. 26
	Moyock	8	Oct. 16 to Oct. 26
	Shawboro	15	Oct. 16 to Oct. 26
	Snowden	10	Oct. 16 to Oct. 26
DARE	Whole county	less than 100	Oct. 18 to Oct. 28
DAVIDSON	Lexington	810	Oct. 16 to Oct. 26
	Linwood	657	Oct. 16 to Oct. 26
	Thomasville	850	Oct. 15 to Oct. 25
	North end of county	at 900	Oct. 15 to Oct. 25
	South end of county	at 600	Oct. 16 to Oct. 26
DAVIE	Advance	787	Oct. 15 to Oct. 25
	Calabahn	750	Oct. 15 to Oct. 25
	Cana	750	Oct. 15 to Oct. 25
	Cornatzer	753	Oct. 15 to Oct. 25
	Farmington	758	Oct. 15 to Oct. 25
	Mocksville	842	Oct. 15 to Oct. 25
DUPLIN	Falson	158	Oct. 23 to Nov. 2
	Kenansville	60	Oct. 23 to Nov. 2
	Rosehill	89	Oct. 24 to Nov. 3
	Sloan	50	Oct. 24 to Nov. 3
	Teacheys	72	Oct. 24 to Nov. 3
	Wallace	53	Oct. 24 to Nov. 3
	Warsaw	154	Oct. 23 to Nov. 2
DURHAM	Bahama	494	Oct. 17 to Oct. 27
	Durham	405	Oct. 18 to Oct. 28
	East Durham	408	Oct. 18 to Oct. 28
	Gorman	363	Oct. 18 to Oct. 28
	Rougemont	549	Oct. 17 to Oct. 27
EDGECOMBE	Conetoe	48	Oct. 19 to Oct. 29
	Macclesfield	100	Oct. 20 to Oct. 30
	Medora	117	Oct. 19 to Oct. 29
	Penelo	110	Oct. 19 to Oct. 29
	Pinetops	100	Oct. 19 to Oct. 29
	Rocky Mount	115	Oct. 19 to Oct. 29
	Speed	60	Oct. 19 to Oct. 29
	Tarboro	52	Oct. 19 to Oct. 29
	Whitakers	121	Oct. 18 to Oct. 28
FORSYTH	Belew Creek	780	Oct. 14 to Oct. 24
	Bethania	768	Oct. 14 to Oct. 24
	Clemmons ville	771	Oct. 15 to Oct. 25

COUNTY	LOCALITY	Elevation above sea-level (in feet)	Ten-day Period for Sowing Wheat
FORSYTH—Cont.	Donnoha	736	Oct. 14 to Oct. 24
	Kernersville	1,010	Oct. 10 to Oct. 20
	Rural Hall	977	Oct. 14 to Oct. 24
	Salem	884	Oct. 14 to Oct. 24
	Tobaccoville	999	Oct. 14 to Oct. 24
	Walkertown	982	Oct. 14 to Oct. 24
	Winston	884	Oct. 14 to Oct. 24
FRANKLIN	Bunn	295	Oct. 19 to Oct. 29
	Franklinton	419	Oct. 17 to Oct. 27
	Louisburg	300	Oct. 19 to Oct. 29
	Youngsville	450	Oct. 17 to Oct. 27
	North end of county	at 400	Oct. 16 to Oct. 26
GASTON	Alexis	886	Oct. 18 to Oct. 28
	Belmont	677	Oct. 19 to Oct. 29
	Bessemer City	900	Oct. 19 to Oct. 29
	Cherryville	909	Oct. 18 to Oct. 28
	Dallas	785	Oct. 18 to Oct. 28
	Gastonia	825	Oct. 19 to Oct. 29
	High Shoals	1,001	Oct. 14 to Oct. 24
	Lowell	770	Oct. 19 to Oct. 29
	Mount Holly	621	Oct. 18 to Oct. 28
GATES	Stanley	852	Oct. 18 to Oct. 28
	Bosley	34	Oct. 16 to Oct. 26
	Eure	22	Oct. 16 to Oct. 26
	Gatesville	27	Oct. 16 to Oct. 26
	Hobbsville	40	Oct. 16 to Oct. 26
	Roduco	35	Oct. 16 to Oct. 26
	Savage	31	Oct. 16 to Oct. 26
	Sunbury	38	Oct. 16 to Oct. 26
	Trotville	39	Oct. 16 to Oct. 26
GRAHAM	Brock	1,800	Oct. 8 to Oct. 18
	Cheoah	2,300	Oct. 4 to Oct. 14
	Japan	1,700	Oct. 12 to Oct. 22
	Robbinsville	2,150	Oct. 8 to Oct. 18
	Stecoah	2,150	Oct. 8 to Oct. 18
	Tuskegee	1,900	Oct. 8 to Oct. 18
GRANVILLE	Bullock	429	Oct. 16 to Oct. 26
	Creedmoor	385	Oct. 17 to Oct. 27
	Hester	384	Oct. 17 to Oct. 27
	Lyons	368	Oct. 17 to Oct. 27
	Oxford	476	Oct. 16 to Oct. 26
	Stem	476	Oct. 17 to Oct. 27
	Stovall	478	Oct. 16 to Oct. 26
	Tar River	327	Oct. 17 to Oct. 27
GREENE	Maury	78	Oct. 21 to Oct. 31
	Snow Hill	74	Oct. 21 to Oct. 31
	South end of county	less than 100	Oct. 21 to Oct. 31
	North end of county	less than 100	Oct. 20 to Oct. 30
GUILFORD	Battle Ground	865	Oct. 14 to Oct. 24
	Brown Summit	800	Oct. 14 to Oct. 24
	Climax	821	Oct. 15 to Oct. 25

COUNTY	LOCALITY	Elevation above sea-level (in feet)	Ten-day Period for Sowing Wheat
GUILFORD—Cont.	Friendship	886	Oct. 14 to Oct. 24
	Gibsonville	720	Oct. 14 to Oct. 24
	Greensboro	839	Oct. 14 to Oct. 24
	High Point	935	Oct. 15 to Oct. 25
	Jamestown	775	Oct. 15 to Oct. 25
	Julian	770	Oct. 15 to Oct. 25
	McLeansville	745	Oct. 14 to Oct. 24
	Oak Ridge	885	Oct. 14 to Oct. 24
	Pleasant Garden	837	Oct. 14 to Oct. 24
	Pomona	868	Oct. 14 to Oct. 24
	Stokesdale	948	Oct. 14 to Oct. 24
	Summerfield	872	Oct. 14 to Oct. 24
HALIFAX	Enfield	99	Oct. 18 to Oct. 28
	Halifax	101	Oct. 17 to Oct. 27
	Hobgood	83	Oct. 18 to Oct. 28
	Littleton	380	Oct. 15 to Oct. 25
	Scotland Neck	100	Oct. 18 to Oct. 28
	Tillery	70	Oct. 18 to Oct. 28
HARNETT	Weldon	75	Oct. 17 to Oct. 27
	Dunn	210	Oct. 22 to Nov. 1
	Spout Springs	332	Oct. 21 to Oct. 31
HAYWOOD	Canton	2,587	Oct. 3 to Oct. 13
	Cataloochee	2,200	Oct. 2 to Oct. 12
	Clyde	2,460	Oct. 3 to Oct. 13
	Crabtree	2,450	Oct. 2 to Oct. 12
	Cruso	2,900	Sept. 29 to Oct. 9
	Mount Sterling	5,000	Sept. 6 to Sept. 16
	Springdale	2,890	Sept. 29 to Oct. 9
	Teague	2,000	Oct. 6 to Oct. 16
	Waynesville	2,637	Sept. 29 to Oct. 9
HENDERSON	Bat Cave	1,472	Oct. 11 to Oct. 21
	Brickton	2,094	Oct. 7 to Oct. 17
	Edneyville	2,247	Oct. 3 to Oct. 13
	Flat Rock	2,200	Oct. 3 to Oct. 13
	Fletcher	2,100	Oct. 7 to Oct. 17
	Hendersonville	2,153	Oct. 7 to Oct. 17
	Hillgirt	2,123	Oct. 7 to Oct. 17
	Horseshoe	2,100	Oct. 7 to Oct. 17
	Naples	2,078	Oct. 7 to Oct. 17
	Zirconia	2,084	Oct. 7 to Oct. 17
HERTFORD	Ahoskie	53	Oct. 17 to Oct. 27
	Cofield	43	Oct. 17 to Oct. 27
	Como	73	Oct. 16 to Oct. 26
	Harrellsville	65	Oct. 17 to Oct. 27
	Tunis	10	Oct. 17 to Oct. 27
	Winton	45	Oct. 17 to Oct. 27
HOKE	Argyle	175	Oct. 23 to Nov. 2
	North end of county.....	at 200	Oct. 23 to Nov. 2
	South end of county.....	at 300	Oct. 24 to Nov. 3
HYDE	Ocracoke (Lighthouse).....	75	Oct. 21 to Oct. 31
	North half of county.....	less than 100	Oct. 19 to Oct. 29
	South half of county.....	less than 100	Oct. 20 to Oct. 30

COUNTY	LOCALITY	Elevation above sea-level (in feet)	Ten-day Period for Sowing Wheat
IREDELL	Barium Springs	995	Oct. 17 to Oct. 27
	Elmwood	837	Oct. 16 to Oct. 26
	Eufola	775	Oct. 16 to Oct. 26
	Harmony	978	Oct. 16 to Oct. 26
	Houstonville	800	Oct. 15 to Oct. 25
	Jennings	900	Oct. 15 to Oct. 25
	Mooreaville	913	Oct. 17 to Oct. 27
	Mount Mourne	851	Oct. 17 to Oct. 27
	New Hope	1,105	Oct. 11 to Oct. 21
	Olin	870	Oct. 16 to Oct. 26
	Scotts	1,060	Oct. 12 to Oct. 22
	Statesville	925	Oct. 16 to Oct. 26
	Troutmans	955	Oct. 17 to Oct. 27
	Turnersburg	750	Oct. 16 to Oct. 26
JACKSON	Addie	2,252	Oct. 3 to Oct. 13
	Balsam	3,338	Sept. 25 to Oct. 5
	Barkers Creek	2,050	Oct. 7 to Oct. 17
	Bessie	3,600	Sept. 22 to Oct. 2
	Beta	2,158	Oct. 7 to Oct. 17
	Bigridge	4,400	Sept. 14 to Sept. 24
	Cashiers	3,550	Sept. 22 to Oct. 2
	Cowarts	2,600	Sept. 30 to Oct. 10
	Cullowhee	2,066	Oct. 8 to Oct. 18
	Dillsboro	2,006	Oct. 7 to Oct. 17
	East Laport	2,186	Oct. 8 to Oct. 18
	Erastus	3,300	Sept. 26 to Oct. 6
	Falcliff	2,500	Oct. 4 to Oct. 14
	Glenville	3,250	Sept. 26 to Oct. 6
	Norton	3,600	Sept. 22 to Oct. 2
	Speedwell	2,250	Oct. 4 to Oct. 14
	Sylva	2,063	Oct. 7 to Oct. 17
	Tuckaseelgee	2,184	Oct. 8 to Oct. 18
	Webster	2,188	Oct. 8 to Oct. 18
	Wilnot	1,881	Oct. 7 to Oct. 17
JOHNSTON	Bagley	170	Oct. 21 to Oct. 31
	Benson	243	Oct. 22 to Nov. 1
	Bentonville	163	Oct. 21 to Oct. 31
	Clayton	345	Oct. 19 to Oct. 29
	Four Oaks	211	Oct. 21 to Oct. 31
	Kenly	204	Oct. 20 to Oct. 30
	Micro	192	Oct. 21 to Oct. 31
	Pine Level	168	Oct. 21 to Oct. 31
	Princeton	153	Oct. 21 to Oct. 31
	Selma	176	Oct. 21 to Oct. 31
	Smithfield	146	Oct. 21 to Oct. 31
	Wilsons Mills	228	Oct. 21 to Oct. 31
JONES	Comfort	51	Oct. 23 to Nov. 2
	Maysville	42	Oct. 23 to Nov. 2
	Pollocksville	20	Oct. 22 to Nov. 1
	Trenton	28	Oct. 22 to Nov. 1
LEE	Colon	335	Oct. 20 to Oct. 30
	Cummock	252	Oct. 22 to Nov. 1
	Jonesboro	419	Oct. 20 to Oct. 30
	Lemon Springs	387	Oct. 20 to Oct. 30

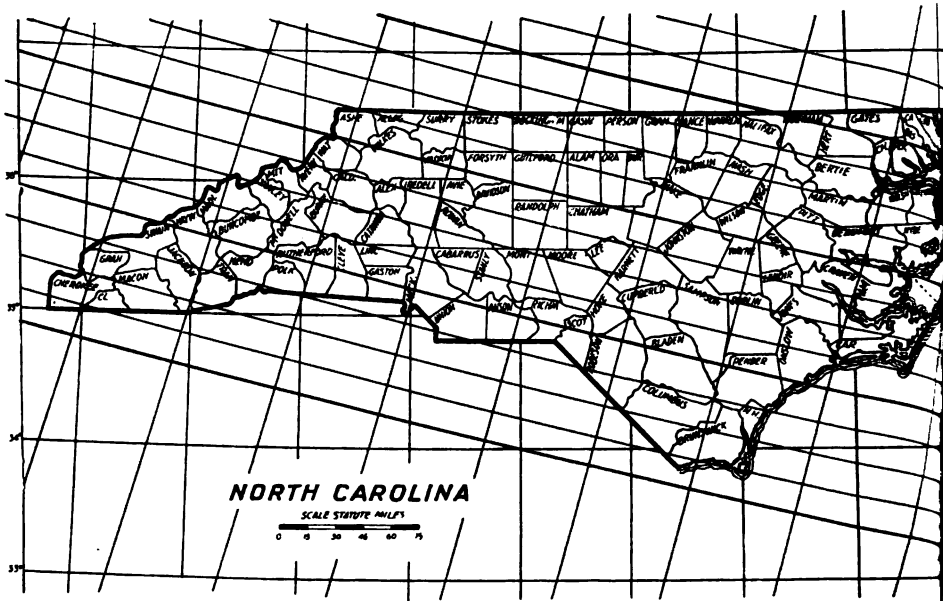


Fig. 1 - Map and C

How to Find Your Best Sowing Dates.—(1) Find your county, then the position of your farm in the county. (2) Follow the nearest line below your location to the calendar on the right of the map. (3) On this line find your dates in the column which is headed by the altitude nearest the average elevation of your general locality.

In a normal season, you should not sow wheat before the earliest date, and if possible you should have the seed in the ground by the latest date. Use your experience and judgment in interpreting these dates to apply to your own conditions this season.

Sow After First Dates to Avoid Fly.—The Hessian Fly is not troubling you much now because most farmers in North Carolina have been sowing wheat after fly-free dates. The Hessian Fly menaces those who sow too early. Destroy all volunteer wheat by plowing, disking, or

ALTITUDE IN FEET ABOVE SEA LEVEL											
200	400	800	1200	1600	2000	2400	2800	3200	3600	4000	
OCT OCT 15 to 25											
16 to 28											
OCT OCT 17 to 27	15 to 25										
18 to 28	16 to 26	OCT OCT 12 to 22									
19 to 29	17 to 27	13 to 23	OCT OCT 9 to 19	OCT OCT 5 to 15	OCT OCT 1 to 11	SEPT OCT 27 to 7	SEPT OCT 23 to 3	SEPT SEPT 19 to 29	SEPT SEPT 15 to 25		
20 to 30	18 to 28	14 to 24	10 to 20	6 to 16	2 to 12	28 to 8	24 to 4	20 to 30	16 to 26	12 to 22	SEPT SEPT
21 to 31	19 to 29	15 to 25	11 to 21	7 to 17	3 to 13	29 to 9	25 to 5	21 to 1	17 to 27	13 to 23	
22 to 1	20 to 30	16 to 26	12 to 22	8 to 18	4 to 14	30 to 10	26 to 6	22 to 2	18 to 28	14 to 24	
23 to 2	21 to 31	17 to 27	13 to 23	9 to 19	5 to 15	OCT 1 to 11	27 to 7	23 to 3	19 to 29	15 to 25	
24 to 3	22 to 1	18 to 28	14 to 24	10 to 20	6 to 16	2 to 12	28 to 8	24 to 4	20 to 30	16 to 26	
25 to 4	23 to 2	19 to 29	15 to 25	11 to 21	7 to 17	3 to 13	29 to 9	25 to 5	21 to 1	17 to 27	
26 to 5	24 to 3		16 to 26	12 to 22	8 to 18	4 to 14	30 to 10	26 to 6	22 to 2	18 to 28	
27 to 6			17 to 27	13 to 23	9 to 19	5 to 15	OCT 1 to 11	27 to 7	23 to 3	19 to 29	
28 to 7			18 to 28	14 to 24	10 to 20	6 to 16	2 to 12	28 to 8	24 to 4	20 to 30	

for North Carolina

otherwise. Coöperate with your neighbors to sow just after the fly-free dates. One early-sown field may infest all the others next spring.

Sow Before Last Dates to Avoid Winter-Killing.—Have seed-bed prepared in best possible manner, finely pulverized and firmly compacted. Early pulverizing and fallowing will conserve moisture and soluble plant food so that the wheat, even though sown late, will grow quickly and strongly.

When in doubt, write to the State or Federal Entomologist for information and advice on the Fly; or to the County, State, or Federal authorities on agricultural practice for information and advice in general.

(Map and Calendar, and text, from poster issued by U. S., Dept. Agr., September, 1917.)

COUNTY	LOCALITY	Elevation above sea-level (in feet)	Ten-day Period for Sowing Wheat
LEE—Cont.	Osgood	255	Oct. 22 to Nov. 1
	Sanford	368	Oct. 20 to Oct. 30
	Swanns	311	Oct. 20 to Oct. 30
LENOIR	Falling Creek	54	Oct. 22 to Nov. 1
	Kinston	44	Oct. 22 to Nov. 1
	Lagrange	108	Oct. 22 to Nov. 1
LINCOLN	Crouse	856	Oct. 18 to Oct. 28
	Denver	950	Oct. 17 to Oct. 27
	Henry	1,102	Oct. 14 to Oct. 24
	Iron Station	896	Oct. 18 to Oct. 28
MCDOWELL	Dysartville	1,262	Oct. 14 to Oct. 24
	Marion	1,437	Oct. 9 to Oct. 19
	Nebo	1,290	Oct. 13 to Oct. 23
	Old Fort	1,437	Oct. 10 to Oct. 20
	Vein Mountain	1,600	Oct. 10 to Oct. 20
	Woodlawn	1,394	Oct. 13 to Oct. 23
MACON	Aquone	2,950	Sept. 30 to Oct. 10
	Cullasaja	2,100	Oct. 8 to Oct. 18
	Duvall	2,750	Sept. 30 to Oct. 10
	Ellijay	2,200	Oct. 4 to Oct. 14
	Etna	1,950	Oct. 8 to Oct. 18
	Franklin	2,099	Oct. 9 to Oct. 19
	Higdonville	2,100	Oct. 9 to Oct. 19
	Highlands	3,817	Sept. 19 to Sept. 29
	Kyle	3,150	Sept. 26 to Oct. 6
	Leatherman	2,150	Oct. 8 to Oct. 18
	Lookout (P.O.)	3,250	Sept. 26 to Oct. 6
	Otto	2,150	Oct. 9 to Oct. 19
	Scaly	3,800	Sept. 23 to Oct. 3
	Shortoff (P.O.)	3,700	Sept. 23 to Oct. 3
	West Mill	2,000	Oct. 8 to Oct. 18
MADISON	Allanstand	2,000	Oct. 5 to Oct. 15
	Barnard	1,532	Oct. 9 to Oct. 19
	Big Laurel	2,103	Oct. 5 to Oct. 15
	Big Pine	2,500	Oct. 2 to Oct. 12
	Bluff	2,150	Oct. 5 to Oct. 15
	Buckner	2,400	Oct. 1 to Oct. 11
	English	3,400	Sept. 19 to Sept. 29
	Faust	3,150	Sept. 23 to Oct. 3
	Hot Springs	1,326	Oct. 13 to Oct. 23
	Ivy	2,085	Oct. 5 to Oct. 15
	Joe	2,650	Sept. 28 to Oct. 8
	Luck	3,100	Sept. 24 to Oct. 4
	Marshall	1,644	Oct. 9 to Oct. 19
	Mars Hill	2,300	Oct. 1 to Oct. 11
	Paint Fork	2,250	Oct. 1 to Oct. 11
	Paint Rock	1,266	Oct. 13 to Oct. 23
	Spring Creek	2,236	Oct. 2 to Oct. 12
	Stackhouse	1,418	Oct. 10 to Oct. 20
	Trust	2,500	Oct. 2 to Oct. 12
	Whiterock	1,800	Oct. 5 to Oct. 15
MARTIN	Everetts	66	Oct. 19 to Oct. 29
	Hamilton	73	Oct. 19 to Oct. 29

COUNTY	LOCALITY	Elevation above sea-level (in feet)	Ten-day Period for Sowing Wheat
MARTIN—Cont.	Hassell	78	Oct. 19 to Oct. 29
	Oak City	84	Oct. 18 to Oct. 28
	Parmele	74	Oct. 19 to Oct. 29
	Williamston	80	Oct. 19 to Oct. 29
MECKLENBURG ..	Charlotte	759	Oct. 18 to Oct. 28
	Davidson	850	Oct. 17 to Oct. 27
	Derita	816	Oct. 18 to Oct. 28
	Huntersville	811	Oct. 17 to Oct. 27
	Matthews	731	Oct. 19 to Oct. 29
	Newell	757	Oct. 18 to Oct. 28
	Pineville	571	Oct. 23 to Nov. 2
MITCHELL	Bakersville	2,470	Sept. 30 to Oct. 10
	Bandana	2,650	Sept. 26 to Oct. 6
	Brummett	2,400	Sept. 30 to Oct. 10
	Clarissa	2,650	Sept. 26 to Oct. 6
	Estatoe	2,700	Sept. 26 to Oct. 6
	Ewart	2,600	Sept. 26 to Oct. 6
	Glen Ayre	3,172	Sept. 22 to Oct. 2
	Hawk (P.O.)	2,900	Sept. 26 to Oct. 6
	Hunt Dale	2,033	Oct. 4 to Oct. 14
	Ledger	2,733	Sept. 26 to Oct. 6
	Magnetic City	2,800	Sept. 26 to Oct. 6
	Mica	2,657	Sept. 26 to Oct. 6
MONTGOMERY ..	General for county.....	at 500	Oct. 21 to Oct. 31
MOORE	Aberdeen	351	Oct. 21 to Oct. 31
	Cameron	312	Oct. 21 to Oct. 31
	Keyser	301	Oct. 22 to Nov. 1
	Manly	437	Oct. 21 to Oct. 31
	Southern Pines	519	Oct. 21 to Oct. 31
	Vass	317	Oct. 21 to Oct. 31
NASH	Battleboro	120	Oct. 19 to Oct. 29
	Nashville	189	Oct. 19 to Oct. 29
	Sharpsburg	140	Oct. 19 to Oct. 29
	Spring Hope	261	Oct. 19 to Oct. 29
NEW HANOVER..	Castle Hayne	20	Oct. 26 to Nov. 5
	Wilmington	29	Oct. 26 to Nov. 5
NORTHAMPTON ..	Conway	108	Oct. 17 to Oct. 27
	Garysburg	145	Oct. 17 to Oct. 27
	Gumberry	132	Oct. 17 to Oct. 27
	Margarettsville	58	Oct. 16 to Oct. 26
	Pendleton	76	Oct. 16 to Oct. 26
	Pleasant Hill	119	Oct. 16 to Oct. 26
	Potecasi	72	Oct. 17 to Oct. 27
	Rich Square	77	Oct. 17 to Oct. 27
	Seaboard	131	Oct. 17 to Oct. 27
	Severn	64	Oct. 16 to Oct. 26
	Woodland	72	Oct. 17 to Oct. 27
ONslow	Dixon	63	Oct. 24 to Nov. 3
	Folkstone	70	Oct. 24 to Nov. 3
	Hollyridge	68	Oct. 25 to Nov. 4

COUNTY	LOCALITY	Elevation above sea-level (in feet)	Ten-day Period for Sowing Wheat
ONslow—Cont.	Jacksonville	15	Oct. 24 to Nov. 3
	Verona	51	Oct. 24 to Nov. 3
ORANGE	Blackwood	485	Oct. 18 to Oct. 28
	Chapel Hill	502	Oct. 18 to Oct. 28
	Efland	662	Oct. 14 to Oct. 24
	Hillsboro	542	Oct. 18 to Oct. 28
	University (P.O.)	471	Oct. 18 to Oct. 28
	North end of county.....	at 800	Oct. 13 to Oct. 23
PAMLICO	Anywhere in county.....	less than 100	Oct. 21 to Oct. 31
PASQUOTANK ...	Elizabeth City	8	Oct. 16 to Oct. 26
	Oklso	12	Oct. 16 to Oct. 26
	South end of county.....	Oct. 17 to Oct. 27
PENDER	Atkinson	64	Oct. 25 to Nov. 4
	Burgaw	57	Oct. 25 to Nov. 4
	Currie	33	Oct. 25 to Nov. 4
	Hampstead	56	Oct. 25 to Nov. 4
	Montague	40	Oct. 25 to Nov. 4
	Rocky Point	40	Oct. 25 to Nov. 4
	Scotts Hill	42	Oct. 25 to Nov. 4
	Willard	51	Oct. 24 to Nov. 3
PERQUIMANS ...	Belvidere	14	Oct. 17 to Oct. 27
	Burgess	13	Oct. 17 to Oct. 27
	Chapanoke	12	Oct. 17 to Oct. 27
	Durants Neck	9	Oct. 17 to Oct. 27
	Hertford	15	Oct. 17 to Oct. 27
	Winfall	16	Oct. 17 to Oct. 27
PERSON	Roxboro	600	Oct. 12 to Oct. 22
	Woodsdale	467	Oct. 16 to Oct. 26
PITT	Ayden	63	Oct. 20 to Oct. 30
	Bethel	69	Oct. 19 to Oct. 29
	Bruce	72	Oct. 20 to Oct. 30
	Falkland	76	Oct. 20 to Oct. 30
	Farmville	82	Oct. 20 to Oct. 30
	Fountain	110	Oct. 20 to Oct. 30
	Greenville	64	Oct. 20 to Oct. 30
	Grifton	28	Oct. 21 to Oct. 31
	Grimesland	44	Oct. 20 to Oct. 30
	Hanrahan	63	Oct. 21 to Oct. 31
	House	31	Oct. 20 to Oct. 30
	Littlefield	65	Oct. 21 to Oct. 31
	Pactolus	21	Oct. 20 to Oct. 30
	Shelmerdine	40	Oct. 20 to Oct. 30
	Stokes	56	Oct. 20 to Oct. 30
	Whichard	46	Oct. 20 to Oct. 30
	Winterville	72	Oct. 20 to Oct. 30
POLK	Columbus	1,109	Oct. 15 to Oct. 25
	Lynn	1,500	Oct. 11 to Oct. 21
	Millspring	1,017	Oct. 15 to Oct. 25
	Rockliff	1,407	Oct. 11 to Oct. 21
	Saluda	2,074	Oct. 7 to Oct. 17
	Tryon	1,075	Oct. 15 to Oct. 25

COUNTY	LOCALITY	Elevation above sea-level (in feet)	Ten-day Period for Sowing Wheat
RANDOLPH	Asheboro	860	Oct. 16 to Oct. 26
	Cedar Falls	503	Oct. 20 to Oct. 30
	Franklinville	463	Oct. 20 to Oct. 30
	Glenola	805	Oct. 15 to Oct. 25
	Liberty	785	Oct. 15 to Oct. 25
	Millboro	753	Oct. 15 to Oct. 25
	Ramseur	442	Oct. 20 to Oct. 30
	Randleman	717	Oct. 15 to Oct. 25
	Sophia	789	Oct. 15 to Oct. 25
	Spero	735	Oct. 16 to Oct. 26
	Staley	724	Oct. 15 to Oct. 25
	Trinity	871	Oct. 15 to Oct. 25
RICHMOND	Ellerbe	253	Oct. 24 to Nov. 3
	Hamlet	325	Oct. 23 to Nov. 2
	Hoffman	427	Oct. 22 to Nov. 1
	Rockingham	211	Oct. 24 to Nov. 3
ROBESON	Allenton	131	Oct. 25 to Nov. 4
	Alma	182	Oct. 25 to Nov. 4
	Bules	182	Oct. 25 to Nov. 4
	Elrod	163	Oct. 25 to Nov. 4
	Lumber Bridge	192	Oct. 24 to Nov. 3
	Lumberton	120	Oct. 25 to Nov. 4
	Maxton	198	Oct. 25 to Nov. 4
	Parkton	187	Oct. 24 to Nov. 3
	Pates	175	Oct. 25 to Nov. 4
	Pembroke	175	Oct. 25 to Nov. 4
	Red Springs	204	Oct. 25 to Nov. 4
	Rennert	187	Oct. 25 to Nov. 4
	Rowland	145	Oct. 26 to Nov. 5
	Shannon	205	Oct. 25 to Nov. 4
	Wakulla	208	Oct. 25 to Nov. 4
ROCKINGHAM	Benaja	675	Oct. 13 to Oct. 23
	Leaksville	700	Oct. 13 to Oct. 23
	Madison	577	Oct. 17 to Oct. 27
	Mayodan	585	Oct. 17 to Oct. 27
	Price	1,005	Oct. 12 to Oct. 22
	Reidsville	826	Oct. 13 to Oct. 23
	Ruffin	707	Oct. 12 to Oct. 22
	Stoneville	818	Oct. 13 to Oct. 23
ROWAN	Bear Poplar	800	Oct. 17 to Oct. 27
	China Grove	821	Oct. 17 to Oct. 27
	Cleveland	789	Oct. 16 to Oct. 26
	Gold Hill	775	Oct. 17 to Oct. 27
	Landis	870	Oct. 17 to Oct. 27
	Mount Ulla	850	Oct. 17 to Oct. 27
	Salisbury	750	Oct. 16 to Oct. 26
	Woodleaf	800	Oct. 16 to Oct. 26
RUTHERFORD	Bostic	739	Oct. 19 to Oct. 29
	Ellenboro	1,060	Oct. 15 to Oct. 25
	Forest City	1,040	Oct. 15 to Oct. 25
	Henrietta	806	Oct. 19 to Oct. 29
	Rutherfordton	1,096	Oct. 15 to Oct. 25
	Thermal City	996	Oct. 18 to Oct. 28
	Up Broad River	at 1,200	Oct. 15 to Oct. 25

COUNTY	LOCALITY	Elevation above sea-level (in feet)	Ten-day Period for Sowing Wheat
RUTHERFORD—Co	Up Broad River.....	at 1,400	Oct. 15 to Oct. 25
	Up Broad River.....	at 1,600	Oct. 11 to Oct. 21
SAMPSON	Autryville	113	Oct. 23 to Nov. 2
	Clinton	159	Oct. 23 to Nov. 2
	Garland	139	Oct. 24 to Nov. 3
	Ivanhoe	32	Oct. 25 to Nov. 4
	Keener	173	Oct. 23 to Nov. 2
	Kerr	86	Oct. 24 to Nov. 3
	Newton Grove	185	Oct. 22 to Nov. 1
	Orange	170	Oct. 23 to Nov. 2
	Parkersburg	121	Oct. 24 to Nov. 3
	Roseboro	134	Oct. 24 to Nov. 3
	Salemburg	167	Oct. 23 to Nov. 2
	Tomahawk	99	Oct. 24 to Nov. 3
SCOTLAND	Hasty	197	Oct. 25 to Nov. 4
	Johns	179	Oct. 25 to Nov. 4
	Laurel Hill	250	Oct. 25 to Nov. 4
	Laurinburg	218	Oct. 25 to Nov. 4
	Old Hundred	337	Oct. 23 to Nov. 2
	North part of county.....	at 400	Oct. 22 to Nov. 1
STANLY	Aibemarle	467	Oct. 21 to Oct. 31
	South part of county.....	at 300	Oct. 24 to Nov. 3
	North part of county.....	at 600	Oct. 21 to Oct. 31
STOKES	Dalton	900	Oct. 14 to Oct. 24
	Danbury	836	Oct. 13 to Oct. 23
	Germanton	676	Oct. 14 to Oct. 24
	King	1,115	Oct. 10 to Oct. 20
	Pine Hall	579	Oct. 17 to Oct. 27
	Pinnacle (P.O.)	1,088	Oct. 10 to Oct. 20
	Walnut Cove	623	Oct. 14 to Oct. 24
	North part of county.....	at 1,000	Oct. 13 to Oct. 23
SURRY	Ararat	898	Oct. 13 to Oct. 23
	Crutchfield	837	Oct. 14 to Oct. 24
	Devotion	1,650	Oct. 6 to Oct. 16
	Dobson	1,257	Oct. 10 to Oct. 20
	Elkin	874	Oct. 14 to Oct. 24
	Goodspring	1,250	Oct. 10 to Oct. 20
	Kapps Mills	1,100	Oct. 10 to Oct. 20
	Ladonia	1,300	Oct. 9 to Oct. 19
	Mount Airy	1,020	Oct. 9 to Oct. 19
	Rockford	813	Oct. 14 to Oct. 24
	Rusk	1,000	Oct. 14 to Oct. 24
	Shoals	769	Oct. 14 to Oct. 24
	Siloam	788	Oct. 14 to Oct. 24
	State Road	1,310	Oct. 10 to Oct. 20
SWAIN	Almond	1,560	Oct. 12 to Oct. 22
	Birdtown	1,900	Oct. 7 to Oct. 17
	Bryson City	1,740	Oct. 11 to Oct. 21
	Bushnell	1,500	Oct. 12 to Oct. 22
	Chambers	1,135	Oct. 16 to Oct. 26
	Cherokee	2,000	Oct. 7 to Oct. 17
	Dorsey	1,550	Oct. 12 to Oct. 22
	Forney	1,450	Oct. 12 to Oct. 22

COUNTY	LOCALITY	Elevation above sea-level (in feet)	Ten-day Period for Sowing Wheat
SWAIN—Cont. ..	Hewitts	1,920	Oct. 8 to Oct. 18
	Judson	1,530	Oct. 12 to Oct. 22
	Nantahala (P.O.)	2,060	Oct. 8 to Oct. 18
	Needmore	1,800	Oct. 8 to Oct. 18
	Oconalufly (P.O.)	2,000	Oct. 7 to Oct. 17
	Parrish	2,000	Oct. 8 to Oct. 18
	Proctor	2,100	Oct. 8 to Oct. 18
	Wayside	1,500	Oct. 12 to Oct. 22
	Wesser	1,650	Oct. 12 to Oct. 22
	Whittier	1,872	Oct. 7 to Oct. 17
TRANSYLVANIA ..	Balsam Grove	2,900	Sept. 30 to Oct. 10
	Brevard	2,230	Oct. 4 to Oct. 14
	Cedar Mountain (P.O.)	2,700	Sept. 30 to Oct. 10
	Davidsons River (P.O.)	2,101	Oct. 8 to Oct. 18
	Lake Toxaway	2,998	Sept. 30 to Oct. 10
	Penrose	2,100	Oct. 8 to Oct. 18
	Rosman	2,180	Oct. 8 to Oct. 18
	Sapphire	3,800	Sept. 18 to Sept. 28
TYRRELL	Whole county.....	less than 100	Oct. 18 to Oct. 28
UNION	Indian Trail.....	696	Oct. 19 to Oct. 29
	Marshville	554	Oct. 23 to Nov. 2
	Monroe	586	Oct. 23 to Nov. 2
	Stout	654	Oct. 19 to Oct. 29
	Waxhaw	645	Oct. 19 to Oct. 29
VANCE	Greystone	490	Oct. 16 to Oct. 26
	Henderson	500	Oct. 16 to Oct. 26
	Kittrell	410	Oct. 16 to Oct. 26
	Middleburg	478	Oct. 16 to Oct. 26
	North end of county.....	at 350	Oct. 15 to Oct. 25
WAKE	Apex	504	Oct. 19 to Oct. 29
	Auburn	336	Oct. 18 to Oct. 28
	Cary	496	Oct. 18 to Oct. 28
	Garner	383	Oct. 18 to Oct. 28
	Method	446	Oct. 18 to Oct. 28
	Morrisville	300	Oct. 20 to Oct. 30
	Neuse	281	Oct. 20 to Oct. 30
	Newhill	330	Oct. 19 to Oct. 29
	Raleigh	362	Oct. 18 to Oct. 28
	Wake (Station)	386	Oct. 18 to Oct. 28
WARREN,	Macon	383	Oct. 15 to Oct. 25
	Manson	428	Oct. 15 to Oct. 25
	Ridgeway	415	Oct. 15 to Oct. 25
	Vaughan	347	Oct. 15 to Oct. 25
	Warren Plains	453	Oct. 15 to Oct. 25
	Warrenton	451	Oct. 16 to Oct. 26
	South part of county.....	at 300	Oct. 18 to Oct. 28
WASHINGTON ...	Mackeys	4	Oct. 18 to Oct. 28
	Roper	13	Oct. 18 to Oct. 28
	Wenona	19	Oct. 19 to Oct. 29
WATAUGA	Amantha	2,820	Sept. 25 to Oct. 5
	Bamboo	3,300	Sept. 21 to Oct. 1

COUNTY	LOCALITY	Elevation above sea-level (in feet)	Ten-day Period for Sowing Wheat
WATAUGA—Cont.	Blowing Rock	4,090	Sept. 13 to Sept. 23
	Boone	3,332	Sept. 21 to Oct. 1
	Green Park	3,800	Sept. 13 to Sept. 23
	Horton	3,100	Sept. 21 to Oct. 1
	Leander	2,750	Sept. 25 to Oct. 5
	Mabel	3,800	Sept. 13 to Sept. 23
	Mast	2,890	Sept. 25 to Oct. 5
	Meat Camp	3,400	Sept. 17 to Sept. 27
	Penley	2,400	Sept. 29 to Oct. 9
	Reese	3,110	Sept. 21 to Oct. 1
	Rutherford	3,300	Sept. 21 to Oct. 1
	Sands	3,250	Sept. 21 to Oct. 1
	Shulls Mills	3,000	Sept. 21 to Oct. 1
	Sugar Grove	2,775	Sept. 25 to Oct. 5
	Sweetwater	2,830	Sept. 25 to Oct. 5
	Valle Crucis	2,720	Sept. 25 to Oct. 5
	Vilas	2,850	Sept. 25 to Oct. 5
	Virgil	2,750	Sept. 25 to Oct. 5
	Watauga Falls	2,630	Sept. 25 to Oct. 5
	Yuma	3,100	Sept. 21 to Oct. 1
	Zionville	3,300	Sept. 21 to Oct. 1
WAYNE	Dudley	180	Oct. 22 to Nov. 1
	Eureka	126	Oct. 21 to Oct. 31
	Fremont	147	Oct. 21 to Oct. 31
	Goldsboro	110	Oct. 21 to Oct. 31
	Mount Olive	157	Oct. 22 to Nov. 1
	Pikeville	135	Oct. 21 to Oct. 31
WILKES	Abshers	1,420	Oct. 6 to Oct. 16
	Benham	1,200	Oct. 10 to Oct. 20
	Boomer	1,450	Oct. 7 to Oct. 17
	Dockery	1,180	Oct. 10 to Oct. 20
	Elkville	1,100	Oct. 11 to Oct. 21
	Lomax	1,300	Oct. 10 to Oct. 20
	Lovelace	890	Oct. 15 to Oct. 25
	Millers Creek	1,220	Oct. 11 to Oct. 21
	Moravian Falls	1,250	Oct. 11 to Oct. 21
	Mulberry	1,300	Oct. 10 to Oct. 20
	New Castle	850	Oct. 15 to Oct. 25
	Osbornville	1,100	Oct. 11 to Oct. 21
	Purlear	1,470	Oct. 7 to Oct. 17
	Reddies River	1,090	Oct. 10 to Oct. 20
	Roaring River	918	Oct. 14 to Oct. 24
	Ronda	912	Oct. 14 to Oct. 24
	Traphill	1,150	Oct. 9 to Oct. 19
	Wilkesboro	959	Oct. 14 to Oct. 24
WILSON	Black Creek	137	Oct. 20 to Oct. 30
	Elm City	131	Oct. 20 to Oct. 30
	Lucama	134	Oct. 20 to Oct. 30
	Stantonsburg	94	Oct. 20 to Oct. 30
	Wilson	145	Oct. 20 to Oct. 30
YADKIN	Boonville	1,067	Oct. 10 to Oct. 20
	Buck Shoal	900	Oct. 15 to Oct. 25
	Chestnut Ridge	1,020	Oct. 10 to Oct. 20
	East Bend	1,048	Oct. 10 to Oct. 20
	Hamptonville	1,050	Oct. 11 to Oct. 21

COUNTY	LOCALITY	Elevation above sea-level (in feet)	Ten-day Period for Sowing Wheat
YADKIN—Cont. . .	Jonesville	1,000	Oct. 10 to Oct. 20
	Marler	1,020	Oct. 11 to Oct. 21
	Yadkinville	980	Oct. 14 to Oct. 24
YANCEY	Bald Creek	2,555	Oct. 1 to Oct. 11
	Bee Log	2,400	Oct. 1 to Oct. 11
	Boonford	2,382	Oct. 1 to Oct. 11
	Burnsville	2,817	Sept. 27 to Oct. 7
	Cane River	2,485	Oct. 1 to Oct. 11
	Daybook	2,350	Sept. 30 to Oct. 10
	Flinty	2,400	Oct. 1 to Oct. 11
	Higgins	2,350	Oct. 1 to Oct. 11
	Micaville	2,504	Oct. 1 to Oct. 11
	Paint Gap	3,000	Sept. 23 to Oct. 3
	Pensacola	2,858	Sept. 27 to Oct. 7
	Sioux	2,100	Oct. 4 to Oct. 14

DISCUSSION OF THE PLAN

The discussion which follows is for the benefit of those who may wish to understand some of the principles upon which the plan for wheat-sowing dates is based. It is not necessary that a farmer should study this discussion to control the Hessian Fly, as that subject has been covered in the preceding pages; this is for the further information of those interested.

The plan was worked out by Dr. A. D. Hopkins, Forest Entomologist, Bureau Entomology, U. S. Department Agriculture, and is elaborated in a paper by him entitled "Periodical Events and Natural Law as Guides to Agricultural Research and Practice," published as Supplement No. 9 of the Monthly Weather Review, May, 1918. We will only attempt to discuss some of the more important features brought out in his paper.

It is found that certain "periodical events," such as the northward advance of the spring season, with its leafing and blooming of certain plants, appearance of certain birds and insects, show a general average variation of four days for each degree of latitude, or one day for each seventeen miles: if two localities are at the same elevation above sea-level and one is seventeen miles approximately north of the other, then it will normally occur that distinctive events of the coming of spring will occur one day earlier at the southern locality than at the locality seventeen miles further north. In other words the spring season advances northward at a general average rate of seventeen miles a day.

But it is of peculiar interest to note that if we take two widely separated localities, both of same elevation and one directly west of the other (both at same distance north of equator), that the "periodical

event" will occur earlier at the western locality. Hence if we are to draw a line across the State of North Carolina such that (at equal elevations) the "periodical event" will occur on the same date at all localities on the line, the line must *trend to the northwestward* to keep pace, as it were, with the more rapid advance of spring in the west. So strong is this tendency that if the whole map of North America be marked with such lines, a line which enters North Carolina at Cape Hatteras passes near Raleigh, passes out of the state in Ashe County, crosses the Mississippi River near St. Louis, and passes out of the United States in northwestern part of Oregon, trending more and more to the northward as it goes west, the point where it leaves the United States in Oregon being about 650 miles farther north of the equator than where it entered the United States at Cape Hatteras. Such a line will be called a line of "equal events at equal elevations," (or an *isophane*).

The "northern limit" of the growth of timber, of potato, of barley and of wheat are all known with fair accuracy. Lines drawn across the map of North America to show the northern limits for these do not run directly east and west, but show the same strong trend to the northwest—in fact they very nearly agree with the "lines of equal events," and strongly support (in fact virtually prove) that the "season" penetrates farther northward as we go west. The same idea has been worked out in Europe also.

From these facts it will be seen that it is possible to lay out a system of lines across the whole country which will indicate a general country-wide average equality in "periodical events" at same elevation.

But the elevations are not equal, so some system must be worked out which will allow for this factor. It is common knowledge among our mountain people especially, that spring will "come" in the valleys before it does on the mountain ridges. This difference has been ascertained in terms of feet and days, and averages one day to each 100 feet. Theoretically, a spot in our mountains at 2,000 feet elevation should show certain "periodical events" (such as blooming of certain flowers) one day earlier than a spot at 2,100 feet elevation. But as slight local features of landscape, such as exposure to north, south, east, or west and nearness of streams or timber will modify this slightly, it is safer to take a larger unit for calculation and allow for a difference of four days for each 400 feet of elevation. In the fall killing frosts occur earlier in our more highly elevated regions in the western part of the state than they do in the lower eastern region. Here then we derive a rule whereby allowance can be made for the elevation of a locality above sea-level in calculating dates for "periodical events," including the sowing of wheat.

It was necessary to have accurate and reliable dates for wheat-sowing

in at least one locality, as a basis from which to calculate. The Experiment Station at Wooster, Ohio, had very complete records of yields of wheat sown at different dates extending over many years, and also records as to the average date when it would be safe from Hessian Fly. Choosing the safest ten-day period at Wooster, Ohio, it was then possible to work out tables of wheat-sowing dates for all parts of the country, figuring from Wooster, Ohio, as a base, allowing one day for each seventeen miles to northward or southward and four days for each 400 feet of elevation, and also allowing for the more rapid advance of seasons to the westward.

It yet remained to see how these dates would fit into actual practice. On this point the theoretical or calculated dates for many localities were compared with the average dates of actual wheat-sowing practice, secured from 40,000 wheat-growers in all parts of the country.

It was found that in certain parts of the country the calculated dates would run a little later than the average dates of actual wheat-practice, and in certain other parts of the country they would run a little earlier. It was found that these regions where the pronounced variations occurred were associated with some geographical feature—i.e., close to ocean, near the Great Lakes, in the arid regions of the southwest and in the high Rocky Mountain region, these variations were especially noticeable. But it was also found that these variations were constant:—if the calculated dates were too early in a locality they were likewise too early for that whole region, and if too late in a locality they were too late for the whole region. This made it possible to average the differences into tables of “corrections” to allow for the retarding or hastening influence that prevailed in different regions. Thus in the map-and-calendar for North Carolina there is recognition of differences of 400 feet elevation in the middle and western sections, but nearer the ocean, a difference of 200 feet is allowed for,—also all the extreme eastern part of the state where the elevation is less than 200 feet is calculated as if at 200 feet elevation. These differences are to allow for the ocean influence.

As Applied to North Carolina.—We have submitted the calculated dates for many representative localities in the state (east, central, and west) to the Division of Agronomy which has conducted careful tests in sowing wheat in many sections, and it is found that they agree well with results of field experiments. We have likewise submitted the calculated dates to several experienced farmers and also to several county farm agents in our main wheat-growing area and find them to be in general agreement. Wishing further confirmation for the very early dates indicated in highly elevated mountain localities, we submitted the calculated date for a certain locality (September 21 to October 1), to an intelligent

mountain farmer of long experience, who wrote that he could not suggest a date more in accord with his ideas. Another mountain farmer agrees with the date (September 17 to September 27) for his locality. During a day's work among wheatfields in Chatham County in June, 1918, the best field seen was sown on October 22d, which was exactly in the middle of the exact calculated period for that locality. It is seen, therefore, that the calculated periods do agree with the experience of actual farmers who are concerned with the yield of wheat. The calculated dates also appear safe from Hessian Fly, so far as we have learned from observation and inquiry in this State.

We have found as much as two months difference in the dates of sowing wheat in the same locality at approximately the same elevation. If there is a "best period" for sowing wheat it cannot extend over so long a time. The sowing-periods as calculated in this circular are intended to stabilize this; they provide for a *ten-day period* for any locality which is judged to be *the best and safest time to sow wheat, all things considered*. Of course this ten-day period is not the same for all parts of the state.

Let us notice for a moment how it would work out if wheat-farmers throughout the state would adopt these calculated dates in their practice. Of all the localities listed the one with the earliest sowing-period is Mount Sterling, Haywood County, at elevation of 5,000 feet, where the period for sowing is September 6th to September 16th. This would be followed by the higher localities in the mountain counties of Watauga, Avery, Ashe, and Jackson, and as season advances by the lower elevations throughout the mountains (earlier in the more northern counties if elevation is the same). Before the sowing period in the southwestern mountain counties was over (October 17 to October 27 in Cherokee) the farmers in the higher localities in the northern part of the state just east of the Blue Ridge would have begun sowing. Then the whole wheat-sowing operation would move toward the southeast, finally ending with sowings in the southeastern corner of the state (Brunswick County) as late as October 27th to November 6th. In brief, the season for sowing wheat would open September 6th, at highest mountain elevations, and would close November 6th, near sea-level in the southeast.

Virtually the whole of the mountain county of Watauga is located between two of the "lines of equal events at equal elevations," (Fig. 1), hence the differences in the sowing-periods for localities in Watauga are based on *elevation* alone, and not on latitude. On the other hand all localities in the eastern county of Sampson are calculated as at 200 feet elevation, but the county is crossed by four of these lines, giving a difference of four days in its extreme northern and southern localities,

based on *latitude* alone, and not on elevation. Nearly all of the county of Davie is between two lines, and all are between 600 and 1,000 feet elevation, hence all dates are calculated for 800 feet elevation, giving the same sowing period for the whole of Davie County, October 15th to October 25th.

Cases occur where the author had a choice:—if a locality is given as exactly 1,000 feet elevation it is optional whether to calculate it for 800 feet or 1,200 feet. Also when a locality is virtually on one of the “lines of equal events” it is optional whether to count it as north or south of the line. In such cases we have calculated localities in the middle section so as to give the later wheat-sowing period owing to importance of Fly in that region.—but in the mountains, where Fly is less important and winter-freezing more important, we have calculated so as to give the earlier sowing-period. These optional differences are never greater than five days.

The whole scheme is *consistent*; where a difference is indicated in the period for near-by localities it is for a distinct reason. The period for Tryon, Polk County, is October 15th to October 25th, but the period for Saluda, scarcely ten miles away, is much earlier, October 7th to October 17th, but this is because Saluda is at much higher elevation. So with every other case.

No intelligent reader would expect that wheat sown within the specified periods will *always* do noticeably better than that which may be sown a few days earlier or later. It is the general average of results that is safest. If soil, fertilization, preparation, and seed be equal, the chances are strong that in any locality the wheat that is sown in the calculated period will do better than that which is sown either before or after that period, in average years. It should not be forgotten that the fixing of these periods rests not only upon the theory of the whole general scheme, but that this has been harmonized with best actual practice through the testimony of many thousands of farmers.

We are aware that many farmers, especially through our chief wheat region, would prefer to sow a little earlier than the calculated dates, but this is the very region in which avoidance of Fly by moderately late sowing is most needed, and our observations show that many in this region in their fear of Fly or for other reasons, actually sow much of their wheat later than the calculated dates, later than is necessary and later than is best.

Figures on Elevations.—In order to make the calculations it was necessary to know the elevations. From the State Geological survey we purchased a typewritten list of “Elevations in North Carolina” (issued since in printed form). From this we secured the elevation for every

postoffice locality of which the elevation was given. These are from surveys of the U. S. Geological Survey, U. S. Coast and Geodetic Survey, State Geological Survey, Railway Surveys, etc., the elevation being that of the postoffice, courthouse, railway station, or other typical place. It then remained to locate each locality on the map, ascertain between which "lines of equal events" (*isophanes*) it belonged, and secure the date from the column on map-and-calendar which was for the elevation nearest that of the locality under study.

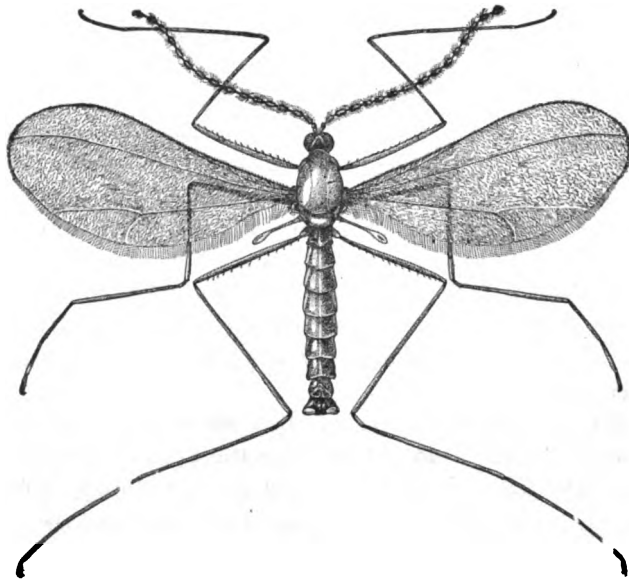


FIG. 2.—Adult male of Hessian Fly. Female has body larger and more pointed at tip. Greatly enlarged.

(After Walton, U. S. Dept. Agr.)

GENERAL ACCOUNT OF THE HESSIAN FLY

History.—The Hessian Fly was originally a European insect, and it is believed that it was introduced into this country in shipments of straw used for bedding (for Hessian troops, hence the name) during the Revolutionary War. It is now established throughout most of the region where fall-sown wheat is grown.

In North Carolina it is apparently present throughout our wheat-growing area, but is more abundant and destructive in the middle and upper piedmont, in the region (roughly) between Raleigh and the mountains. We have found it in wheat as far east as Warren County—and in the mountains of Buncombe County. Correspondents report it as occasionally destructive in other mountain counties.

Two Main Broods.—It apparently has two main broods (or genera-

tions) each year, perhaps sometimes a partial or entire third brood. The adult flies of one of these main broods emerge and lay eggs in early fall and it can therefore only infest early-sown wheat which is up at the time. The adult flies of the other brood emerge in spring (our rearings indicate mid-May as the chief time in our main wheat section), and these of course will infest any growing wheat.

Description and Life History.—The adult parent female insect which lays the eggs is a small, frail, dark-colored, two-winged fly, somewhat resembling a small dark mosquito. Fig. 2 illustrates the male; the female is similar in general appearance, but body larger and more pointed at tip.

Emerging from old stubble in fall the females lay their eggs upon the blades of whatever growing wheat they can find. These eggs hatch to very small maggots, which work down under the sheath of the blade and imbed themselves in the soft tissues of the main stem. These maggots are white, yellow, or reddish in color, and it is this form of the insect which does all the the actual damage, rasping and cutting into the tissues and absorbing the juices, which weakens the plant. At first the plants may be even darker green than normal, but later they turn yellow and may die. Many of these maggots become full-grown before severe winter, and they then change to what is called the "flax-seed" (technically known as the *pupa* stage. These "flax-seed" are small and brown (hence the name) but are more cylindrical or spindle-shaped than a seed of flax. From these over-wintering "flax-seeds" a brood of adult Flies emerges in spring (mid-May in our chief wheat region, from our own rearings) which then lay eggs and the life-history is repeated, yielding Flies in fall. The work of the insects in the spring causes the straws to weaken and fall so that they cannot well be harvested, and prevents the maturing of proper amount of grain.

General Notes.—The maggots do not actually bore into the inside hollow part of the straw—the maggots of some other flies do this. The small yellow or green jumping insects which are often seen in small-grain fields are not "Hessian Fly," as they are often called, but are "Leaf-hoppers." There are several small insect parasites which prey upon the Hessian Fly in its maggot and flax-seed" stages.

An illustration in this circular shows the general course of life of the insect through the months of the year. The main food-plant of Hessian Fly is wheat, though it has occasionally been found on rye and barley. It has not been known to attack oats or grasses, so far as the writer is aware. It is primarily a *wheat* insect.

